



**The Human Body as an Instrument: An Investigation into its Music**

A project submitted in fulfilment of the requirements for the degree of Master of Fine Arts (Research)

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## **Declaration**

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis/project is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Graeme R Croft

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Notice of Ethics Approval for the project, from the Design and Social Context  
College Human Ethics Advisory Network at RMIT University (CHEAN).

# Project Proposal

## 1. Summary:

My research into the music of the human body began with investigating the history and practice of music which incorporates the internal sounds of the body.

I initially located and studied recordings and performances which included these sounds in order to clarify some of the conceptual possibilities for their compositional use. Important themes which emerged were:

- my interest in the sounds of the natural soundscape rather than sounds which have been abstracted through processing,
- the effect of the presence of the recordist's body sounds on the listening experience, and
- the recordist as the performer in both live and recorded works.

I have explored these themes further in my works.

My examination of technologies has revealed that recording and amplifying body sounds has arisen out of medical listening and developments in listening technologies. Extending my sonic study of the body beyond this project would most likely involve ultrasound or other methods which sonify the electrical activity of living tissue (such as muscle or nervous tissue).

My project has required the development of practical approaches to the transduction and sonification of internal body sounds. My initial experimental works in the studio were samples based. They led to further works and to two major projects: **field recordings**, which involved recording my body at the same time as the sound field, and **live performance works**, focussing on the body as a performing instrument.

New knowledge about the body as an instrument has arisen out of this research. For example, my experience as a performer has led to knowledge about the sonic image of the body in performance. My experience as a listener has led to knowledge about the body and its enactments (Mol 2002). Examination of different mixes of the same recording has led to knowledge about the 'Point of Audition' (Chion 1994), the 'Repetition Effect' and the 'Ubiquity Effect' (Augoyard & Torgue 2005), and embodied listening (with reference to the work of the American philosopher Drew Leder) (Leder 1990).

## **2. Description**

### **2.1 Introduction**

The lone man had to find his symphony within himself, not simply by thinking up music in the abstract but by being his own instrument. A lone man possesses much more than the twelve notes of the trained voice. He shouts, he whistles, he walks, he punches, he laughs, he calls out. His heart beats, his breathing accelerates, he pronounces words, calls out and others call in reply (Schaeffer 2012, p. 47).

The French acousmatic pioneer Pierre Schaeffer provided this evocative insight into his ground-breaking ‘Symphonie pour un homme seul’, composed with his colleague Pierre Henry. Theirs was a major early work of the (then) new acousmatic genre, which included recorded sounds produced by the human body as compositional materials. Even in the present day, these materials remain relatively unexplored in terms of their use in compositions and sound works.

My interest in these sounds and their implications for creative practice led to this research, in which I have investigated the sounds which arise out of the interior of the body and have used them to create a series of sonic works.

## 2.2 Background

The notion that sounds other than those of traditional musical instruments can be legitimate materials for composition, is not new. In his manifesto from 1913 'L'Arte dei rumori ('The Art of Noise'), the Italian Futurist Luigi Russolo vigorously advocated the expansion of timbres in music from traditional instrumental sounds to the inclusion of noise sounds of all types, and pointed out their richness and variety:

Let us cross a large modern capital with our ears more sensitive than our eyes. We will delight in distinguishing the eddying of water, of air or gas in metal pipes, the muttering of motors that breathe and pulse with indisputable animality, the throbbing of valves, the bustle of pistons, the shrieks of mechanical saws, the starting of trams on tracks, the cracking of ships, the flapping of awnings and flags. We will amuse ourselves by orchestrating together in our imagination the din of rolling shop shutters, the varied hubbub of train stations, iron works, thread mills, printing presses, electrical plants, and subways. Nor should the newest noises of modern warfare be forgotten (Russolo 1986, p. 24).

More recently, the French composer Pierre Schaeffer advanced the notion of 'acousmatic listening'. As he outlined in his 'Traite des objets musicaux' (Schaeffer 1966), acousmatic listening involves listening as if the sound source is behind a screen, so that the source cannot be identified visually. Schaeffer maintained that knowing the source of a sound influences how the



sound is heard and that the acousmatic procedure means that sounds can be perceived without bias: 'By listening to sonorous objects whose instrumental causes are hidden, we tend to forget the latter and to take an interest in these objects for themselves' (Schaeffer 2006, p. 78).

But it also means that these sounds can be considered as musical resources. As he stated: 'Such is the suggestion of acousmatics: to deny the instrument and cultural conditioning, to put in front of us the sonorous and its musical possibility' (Schaeffer 2006, p. 81).

The view that ordinary sounds can be used musically was also a key principle in the writing and creative practice of the American musical pioneer John Cage. In responding to a statement made about sound by the American composer of experimental music Christian Wolff (in Wolff 1998, p. 24), Cage wrote:

"Sound comes into its own": what does that mean? For one thing, it means that noises are as useful to new music as so-called musical tones for the simple reason that they are sounds (Cage 1973, p. 68).

This idea was an historical shift, from the privileging of traditional musical sounds as musical resources, to including all sounds in music. And with the development of recording, electronic sound production, processing and

sampling technologies, sounds of all types have become accessible to the composer.

As a woodwind performer, my focus has been on my body as the site of the production of sounds, by means of the movements of my fingers, mouth, tongue, diaphragm and supporting skeleton. But instrumental sounds are external to the body, and the processes are voluntary. The work of Russolo, Schaeffer and Cage left me wondering about the internal sounds created by the body, through its anatomy and physiology. Technology has meant that these sounds can be amplified and recorded. If sound has really 'come into its own', what does it mean to think of the internal body as an instrument? What are the musical implications which arise out of considering the internal sounds of the body, created by the heart, the lungs and abdominal organs, as legitimate compositional resources?

My research initially involved exploring these ideas as revealed in existing relevant works. I located my position within this field, investigated how the sounds of the body could be accessed, and developed my own compositional work.

### **2.3 Review of Human Body Works and Current Practice**

Sampled body sounds from single sources have been used in recorded musical compositions in a range of genres. For instance, within the formal electro-acoustic tradition, the German composer Karlheinz Stockhausen used a sample of his breathing sounds in his important formal tape work 'Hymnen' (Stockhausen & Stockhausen 1997). This is a collage work in which the body sound material appears to add a referential, human element to the soundscape.

In 'Lullaby from the Womb', Dr Hajime Murooka, a Japanese Professor of Gynecology, recorded arterial and venous sounds using a microphone placed in the vagina, close to the cervix and near the head of the foetus, of a woman who was eight months pregnant. He created a series of recorded works comprising this material on its own, or mixed with classical music pieces such as 'Traumerei' by the noted German composer Robert Schumann, with the intention that parents could play the recordings to calm their crying baby by recreating the (presumed) comforting aural environment which their child had experienced in utero (Murooka 1974).

Matmos, a San Francisco-based electronic duo formed by Drew Daniel and Martin Schmidt, used sampled sounds from surgical procedures, such as the vibration of the human skull and the flow of blood in the jugular vein, in their album titled 'A Chance to Cut is a Chance to Cure' (Matmos 2001). This is in the style of techno music, with the addition of sound loops and samples which are all strongly referential of their sources. Many of the titles of works

reference surgical procedures. For example, 'Lipo Studio and So On' contains the sucking and tearing sounds of liposuction. These sounds create a counterpoint within what is otherwise familiar music of this genre.

In the arena of film music, Roger Waters, the English musician and co-founder of the English progressive rock band 'Pink Floyd', and his colleague the Scottish musician and composer Ron Geesin, also used unabridged sampled body sounds in their music for 'The Body', a film about the workings of the human body (Waters & Geesin 1970). Their compositions are melodic, with traditional harmonies and a varied range of styles: singer-songwriter vocals with backing guitar and bass, classical string duos or trios, and more complex instrumental writing. The body sound material is varied, and the samples are short in duration. For example, the first track 'Our Song', uses body percussion, farting noises, exhalations and vocalizations.

Unprocessed body sounds from a single source have been used in a soundscape work. As reported by the American poet Kenneth Goldsmith, the artist Lauren Lesko inserted a contact microphone into her vagina and recorded her internal sounds while walking, in her work titled 'Thirst' (Goldsmith 2004).

Recorded body sounds have also been abstracted through processing and used in recordings. The Japanese sound sculptor and noise artist Aube (Akifumi Nakajima) produced a series of albums in which his sound material comprised single sound sources derived from the body, such as the sound of

the heartbeat and the sonification of the electroencephalogram (brain wave recording).<sup>1</sup> For the most part, the level of abstraction is such that the origin of the sounds is no longer recognizable. In 'Cardiac Strain' (Aube 1997), the heart sounds are (from my listening) jagged, percussive or machinery-like, and at times subjected to simple pitch transformations and rhythmic repetitions which mirror the heart beat.

Body sounds have been used in live performance works, in different ways with different intentions. The American electro-acoustic pioneer Richard Teitelbaum, who was one of the founders of the Italy-based electro-acoustic group Musica Electronica Viva, used amplified brain waves, heart sounds, breath sounds, and a Moog synthesizer in his work titled 'In Tune' (Teitelbaum 1976).

The performer Barbara Mayfield was fitted with electrodes to detect her brain waves, and with heart and throat contact microphones to amplify her heart and breath sounds. The voltages of her brain wave alpha rhythm were used to trigger the synthesizer and to modify its outputs. Teitelbaum's role was to mix and pan both Mayfield's body sounds and the Moog sounds. His account of the performance included that it involved him taking on the role of a 'spiritual guide', with Mayfield being the subject, and manipulating the sonic materials so as to assist Mayfield in experiencing altered states of awareness.

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<sup>1</sup> Aube 1997, *Cardiac Strain*, Alien8 Recordings, Montreal, Canada; Aube 1998, *Substructural Penetration*, Iris Light Records, Cornwall, UK; Aube 2000, *Blood-Brain Barrier*, Ytterbium 03, France.

As he explained in his score of 'In Tune':

The guide gathers together the subject's body rhythms and helps make a sound image of the electronically extended organism.

The sound image thus created becomes an object of meditation which leads the subject to experience and explore new planes of Reality (sic) (Teitelbaum 1976, p. 43).

The Cyprus-born, Australian artist Stelarc has used body materials in his performance works, including brain waves, heartbeat sounds, muscle electrical signals, stomach activity recordings via a swallowed transducer in his stomach, and a mechanical hand controlled by his body. His work is organized around the theme of sound as an organizer in the mythic future development of the human form, posited as being from the human body to an inhuman cyborg:

The amplified internal rhythms, laser eyes and mechanical hand acoustically and visually expand the body's parameters. They can no longer be seen as biofeedback situations (they never really were) but rather SCI-FI SCENARIOS for human-machine symbiosis --- with sound as the medium that reshapes a human body, for redesigning an obsolete body (Stelarc 1989, p. 27).

I have only located one performer who is currently using amplified body sounds in live works. This is the English sound artist Andre Borges. His

performance of 'Inside Out', as viewed on YouTube (Borges 2011), features Borges dramatically seated, bare-chested, with microphones attached to his chest and abdomen. The piece begins with the sound of his heartbeat (which seems timbrally unreal, perhaps due to filtering). Early on in the performance, he places a medical breathing mask over his face, to which is attached a microphone, so that his breath sounds can be added to his heart sounds.

Various percussion instruments are activated during the performance, which adds textural and timbral interest, and assists in creating a varied and at times tension-ridden soundscape. Borges creates contrast by varying the loudness and intensity of his breathing and by vocalising with whimpering guttural noises. In addition, by breathing rapidly and deeply, he accentuates the loudness of his heart pulsation. His gut sounds are not obvious. He uses lighting to highlight the drama of the performance: the focus is initially on his body but shifts to a single light which pulses on and off with his heartbeat.

This work is interesting in many ways, such as in its intensity, emotional impact and its theatrical nature. It is also interesting to see that Borges appears to control his sounds through physical gesture only rather than with an additional controller, uses other sound sources and lighting to add interest to the work, and apparently uses a sound engineer rather than his own resources to manage sound production and distribution during the performance.

Body sound materials have been used in gallery works. Some artists have made their own body a central feature of the work. An example is 'Corp etranger', from the Lebanese-born artist Mona Hatoum, in which she explored her body and various types of intrusion into her body. The piece comprised looped video footage of the internals of her body (taken with the help of an endoscopist), shown on a circular screen situated on the floor of the gallery, accompanied by the recorded sound of her heartbeat (Ohlin 2009).

On the other hand, the San Francisco-based Japanese composer and koto player Miya Masaoka used the bodies of others to explore body soundscapes in her work titled 'What is the Sound of Ten Naked Asian Men?' The piece involved ten men lying naked on massage tables, with their bodies wired for heart and other body sounds, electrocardiogram and brain waves. Marianne Messina, a music and dance writer, reported that the body sounds were amplified and mixed with Masaoka's koto, to create 'a lively jam session' (Messina 2000, p. 3).

Sound artists have also used body sounds in installations. The Australian artist Blaide Lallemande has described her work 'light of heart' (sic) as 'an investigation into ways of embodying presence on a collective and individual level' (Lallemand 2014, p. 1). Up to five audience members at a time were invited to place a heart object (an acrylic moulded form which incorporated a stethoscope head and microphone) against their chest, over their heart. The sound of the heartbeat was amplified and could be heard in the room. The impulse and rhythm of the beat could also be seen: it created rhythmic ripples



in the water which partially filled a large satellite dish, by means of up to five transducers attached equidistantly around the edge of the dish. The work provided a shared and interactive, visual and aural experience of otherwise concealed, internal heart rhythms.

A work using body sound samples is that of the United Kingdom-based sound artists Harry Neve, Anna Orliac and Thomas Michalak, who collaborated with a surgeon to produce an interactive installation titled 'Sonic Body'. Externally, it had the appearance of a cylindrical pod. Internally, it was fitted with fabric surfaces representative of the interior of the human body, which when touched or squeezed by the audience participant, triggered sound samples previously recorded from the interior of the bodies of Neve and his colleagues. This created what Neve has described as 'a symphony', or 'orchestra of the human body' (Neve 2010, p. 1).

### **3. Research Questions**

My research inquiry has been based on the following three questions:

- How can the history and practice of music which incorporates the internal sounds of the body be used as a basis for new sonic art works?
- How can technology advance our understanding of the internal body as a musical source of sound?
- What is revealed through the composition of sonic art works which incorporate the internal sounds of the body?

#### **4. Rationale:**

The field of study within which my project is situated is that of the human body. This is a key theme of diverse interest within our popular culture. For example, on Melbourne free-to-air television in the week beginning Friday May 3rd 2013, the body was depicted in competitive sport (football, rugby league, swimming, diving, skiing, cycling, netball, athletics, golf, basketball and baseball) and in a programme involving celebrities and diving ('Diving Celebrity Splash'). There were programmes to do with the body and illness ('RPA', 'Children's Hospital' and 'Embarrassing Kids Bodies'), the anatomical body ('Guts', which involved exploring the human alimentary tract by means of a swallowed camera), the legal body (a legal programme 'Personal Injury Law' which gave advice about compensable injury to the body), and the aesthetic body (programmes on weight loss and exercise) (The Age Green Guide 2013).

Within the world of visual art, this cultural interest is manifest in the importance given to the role of the body and its representation as a key subject in art works.

In the field of music, the traditional role of the body has been in producing vocal music and in being the source of musical gesture. However, as I have outlined, new ways of thinking about sound and developments in recording technologies have led to new creative practices in which sound materials of all types are being used in sound works.

Within music, sound art and their associated fields, the use of body sound materials is still a marginal practice. Perhaps this has come out of the fact that even with new recording technologies, body sounds are not easily accessible, or are considered to be abject and not appropriate for composition.

From a creative point of view, this has meant that within the field of the body and its sounds, there are still many areas to be explored. As outlined, while composers in various genres have used sampled materials which have been recontextualized, abstracted or manipulated, and performance artists have used unprocessed body sounds in live settings to explore body relations, there has been little work by artists focussing on the body (as represented by its sounds) and its relationship and interaction with its environment. In addition, improvisational practices involving the musician combining external instrumental sounds produced out of musical gestures with his or her internal body sounds, have received little attention.

My project has involved developing techniques for using sounds from the body as a means of creative exploration. In doing so, I have contributed to new knowledge about the body as a sonic instrument in its own right. In exploring and using technologies to do with amplifying body sounds, I have also investigated and documented approaches and techniques that can be used by other musicians and sound artists.

## 5. Methods and Their Development:

There have been four key elements to my project:

- my bibliographic inquiry,
- my listening inquiry,
- my investigation into technologies which provide access to body sounds, and
- my creation of works.

My research process has been creative and interactive: each element has had its own developmental trajectory, and has affected each other element as the project progressed.

I approached my bibliographic inquiry by exploring composers who have written about sound works which have involved the body and its sounds, such as the American composer David Rosenboom (Rosenboom 1976), who has provided detailed accounts of early performance-based works using the electroencephalogram (brain wave recording). I also examined the development of the acousmatic use of sounds as outlined, for example, in such books as Pierre Schaeffer's seminal 'In Search of a Concrete Music' (Schaeffer 2012).

I explored the field of sound art practices as a way of contextualizing my practice, through such writers as the American journalist and composer Alan Licht (Licht 2009). As the project developed, I began to examine perspectives on the body such as those provided by the Dutch ethnographer

Ann Marie Mol (Mol 2002) and by the American philosopher Drew Leder (Leder 1990).

My listening inquiry has been ongoing. I located works which incorporated body sounds and examined the technical means by which the sounds were obtained, the different creative approaches taken by composers and arts practitioners, and the genre and style of the resultant works.

My investigation into technologies initially involved trialling different microphones (dynamic, condenser, and contact microphones) in order to record body sounds, and purchasing and investigating other recording tools (such as a Doppler ultrasound device). I used computer-based resources and the programme Logic Pro to process recorded samples, as well as the programme Max/MSP to make sample-based compositions and to create performance interfaces. I subsequently made my own stethoscope-microphones by fitting lavalier microphones to stethoscope heads, which I used with digital recorders to record sounds, and with computer interfaces, computers, sound processing equipment and powered speakers, to perform sounds.

I was initially only able to use samples in my compositions. However, as my experience with recording and technologies developed and I made my own microphones, I was able to undertake real-time recording and amplification of sounds in works. This led to my two projects of **field recordings** (soundscape recordings and soundwalks), and **live performances**.

The early **field recordings** began as experiments in utilising technology. The methodology which arose subsequently involved organising my recording sessions around a set of activities and sites. My approach was to record the activity or site, and to re-record it at a later date in order to have a more intensive engagement with the place or the experience. My recording list included:

- the body in action (in household activities such as washing the dishes, boiling a kettle, and watching television),
- the body in outdoor physical activities (such as walking, riding a bicycle, driving a car and taking an escalator),
- the body playing a musical instrument (the flute, clarinet and keyboard),
- the body being subject to an activity (as a passenger in a car and a train),
- the body within a locality (such as in selected parts of the city of Melbourne and in the Melbourne suburb of Clifton Hill),
- the body at a country farm property (at Tolmie, in country Victoria),
- the body in a particular historic locality (the Cheviot tunnel near Yea), and
- the body in a sociocultural place (the Victoria Market, the Victoria Gardens and Box Hill shopping malls, and Spencer Street Station).

In the second year of my project, field recording sessions took place twice a week, with multiple recordings each usually of between three and five minutes

in duration. Post recording, I imported the sound files into the programme Logic Pro for listening, editing and mixing.



Figure 1 (Top): Documentary image from the field recording session along the Yarra from Prince's bridge, 12 May 2014. Photo: Graeme Croft.

Figure 2 (Bottom): Documentary image from the field recording session at the Cheviot Tunnel, Yea, Victoria, 31 Jan 2014. Photo: Graeme Croft.



The **live performance works** began as experiments in improvising on contra-alto clarinet while triggering samples of body sounds with a MIDI foot-controller, using a programme which I wrote in Max/MSP. After learning how to amplify heart, breath and gut sounds live, I developed a series of performance interfaces in Max/MSP which used a Korg MIDI controller to provide gestural input by controlling the volume of the outputted sounds. The first work performed publicly was a collaborative improvisation titled 'Communicating Vessels: The Body as Voice', in which I performed my body sounds and frog sound samples, and a colleague played a wine glass as a percussion instrument.

There were two performance configurations in the next set of works: the first with a flautist colleague on concert flute and myself improvising with my body sounds, and the second with my colleague improvising with her breath sounds and bass flute, and myself with my breath sounds and contra-alto clarinet. A third series of works was for two performers (myself and another colleague) playing a body sound duet.

These new works also led to developments in the performance interfaces and to processing sounds (with filtering and compression) in order to maximize their sonic impact in performance.



## **6. Outcomes and Questions**

While the creation of sound works has been the focus of my research, there have been other outcomes, several of which I would like to discuss.

### **6.1 A Personal Shift: from Body Sounds to the Body**

A significant development occurred as I entered the second year of the project. It was to do with how I thought about what I was doing. The focus in my early thinking was on the sounds of the body, and the ways in which they could be used in works. But as time went on, my focus shifted from sounds, to my activity and to the body itself.

Questions arose such as, what was I performing when I amplified the sounds of my body: was I performing my body, or was I simply creating works which used body sounds? What did it mean for another person to hear the sounds of my body in a recorded work: were they heard only as sounds, or did the listener hear my sounds as a body? If the latter was the case, what was the effect on the listener? For example, did the presence of my body sounds invite the listener to have more personal experience of my sonic world? What did it mean to me as the recordist to know that my body sounds could be heard by others in recordings, and were preserved by the recording process?

This shift was also reflected in my Community of Practice. I will provide examples of some of the themes which emerged by discussing several works

in more detail, in order to provide an understanding of this development and its effect on my compositional outcomes.

The first work is from the Spanish sound artist Francisco Lopez, and is his recording of the La Selva rainforest during 1995 and 1996, titled 'La Selva' (Lopez 1998). The work comprises the soundscape of the forest presented with minimal processing of the recorded material, so that it is heard in its natural state. The relevance of this work to my project is several-fold. An important principle is that it is a recording of an environment in which all sounds have been included, regardless of their significance. Lopez has previously expressed the view that in traditional nature recordings, certain sounds are privileged and isolated from other sounds through recording and editing processes, and that in La Selva, all sounds appear without distinction (Lopez 2006). My interest in including the body of the recordist and its sounds in my recordings has involved a similar principle.

A second principle arising from this work is that it is of the natural soundscape. In my two projects, I have used technology to access and record sounds of the natural body rather than to (additionally) abstract them through processing.

Thirdly, there is the issue of the type of listening which is involved: Lopez has highlighted the value of listening acousmatically (to the extent that this is possible) in order to appreciate the sounds without the distraction of their origins.

As he has advanced, in writing about listening:

I prefer this environmental perspective not because it is more “complete” or “realistic” but because it encourages a perceptual shift from the recognition and differentiation of sound sources, to the appreciation of the resulting sound matter (Lopez 2006, p. 83).

An important theme in my work has been to do with gaining access to sounds of the body which have been largely overlooked in music and arts practice. My research has involved developing ways of accessing these sounds and discovering their variety and beauty.

‘The Sound of Light in the Trees’ by the American composer and sound artist David Dunn (Dunn 2006) addresses similar issues. His samples-based collage piece was created out of his field recordings of the interior of pinyon pine trees (a species of forest tree of the South-Western United States). The engraver beetle has invaded large areas of pinyon forest, which has been attributed to climate change. Dunn developed novel recording technologies which he used to access the interior of the trees and to record the otherwise hidden internal sounds, which included the sounds of the activity of the beetle. As he has written in his CD liner notes:

My intention in the composing of this collage was to convince the listener of the surprising complexity of the sound occurring within one species of tree as emblematic of the interior sound worlds of trees in general (Dunn 2006, p. 1).

Including my own body sounds in works has led me to consider the presence of the author in sound works and how this presence is revealed. For example, the body of the German-born, Canadian composer Hildegard Westerkamp is evidenced through the presence of her speaking voice in 'Kits Beach Soundwalk' (Westerkamp 1996). This complex and beautiful work is in the form of a soundwalk, expressed through sound and narrative, in which the listener is drawn into experiencing the work by the voice of the composer. It begins with the sound world of Kitsilano beach in Vancouver, with sounds from the beach, of lapping water, of barnacles, of birds and sounds of Vancouver city.

Through the timbre, measured tempo and intimacy of her voice, and through her interpretation of the setting, Westerkamp leads the listener into this world. She then embarks on an imagined journey through a series of dreams, linked by the sounds of places, sampled works of the composers Iannis Xenakis and Wolfgang Amadeus Mozart, and named sounds from the life of a peasant family. The work ends with a climatic and emotional return to the city.

‘Breathing Room’ (Westerkamp 1990) also features Westerkamp’s body, this time in the form of her breath sounds. In her compositional notes on her website, she has given the following explanation:

This is the second in a series of ‘*Breathing Room*’ pieces. Music as breath-like nourishment. Breathing as nourishing musical space. The breath --- my breath --- is heard throughout the three minutes. All sorts of musical/acoustic things happen as I breathe in and out. Each breath makes its own, unique statement, creates a specific space in time. Meanwhile, the heart beats on, propelling time from one breath to the next (Westerkamp 2014).

The work is structured around Westerkamp’s breathing: as she breathes in and out, other sounds of birds and water come to a crescendo and die away. A quiet, percussive, heartbeat can be heard in the background for most of the piece, along with other percussive and drone-like textural sounds.

A very different experience for the listener of the presence of the author in a sound work involves the listener being affected by the composer’s instruction. The Japanese artist Yoko Ono has written a series of conceptual art works, some of which include the body, which have been published in her small volume ‘Grapefruit’ (Ono 1970). ‘BEAT PIECE’ (sic), first performed in New York in 1965, gave the instruction ‘Listen to a heartbeat’. Audience members responded by coming onto the stage, huddling against each and listening to their neighbour’s heartbeat. For her work titled ‘BREATH PIECE’ (from 1966),

a large piece of card with the lettering “breathe” was passed around the audience.

As my field recording work progressed, I became more aware of how my body articulates its environment. For example, as the effort required for walking or other activity varies, so does my heart rate and rate of breathing. And along with the other sounds of my body, such as my footsteps on the ground, the creak of the strap which supports my recorder bag, the brush of my clothing against a chest microphone and the reverberation of these sounds in the space, the engagement of my body with the place is revealed.

Two notable works explore or reference this interaction. The first is ‘Body Music 1’, by the New York-based composer and multimedia performer Charlemagne Palestine (Palestine 1973). This video work, which is discussed in his book ‘Running ‘N Chanting ‘N Falling ‘N Ranting’ (Palestine 2014), features Palestine in a large room, initially sitting and hitting his knees rhythmically against the floor and then running noisily in the room and into the walls with great intensity, as if he is responding actively and chaotically to being trapped in the space.

The second is an installation by the Melbourne artist Lisa Roet, which I experienced at the Forum Theatre, Melbourne as part of the 2014 ‘White Night Festival’. It was also an example of the physical presence of the body of the artist in the work, specifically her heart, and was one of the pieces in a multimedia investigation of the body titled: ‘The Chamber of Curiosities’.



Roet's work 'Monkey HEART' (sic) is part of an oeuvre involving the exploration of human and primate relations. This particular piece had several elements. The central focus was a large, video projection of a pulsating heart on the stage, which appeared to be in 3-D. The programme notes indicated that this was an animation using merged elements of Roet's heart (videoed during heart surgery which she underwent at the Monash Medical Centre, Melbourne) and the heart of a gorilla (Crawford 2014). A number of stations situated in the theatre featured video: of Roet's operation, of a surgical procedure on a monkey, and of ultrasound images of the heart. A multichannel sound recording which incorporated synthesized heart and vascular noises of pumping, slapping and squelching was part of the installation.

A feature of the work was its location and how the different elements interacted with the location. The necessity of walking from station to station, in part in order to gain a closer view of the pulsating heart, meant that experiencing the work meant experiencing it in relation to and along with its context. This was the dimly-lit Forum theatre, elaborately decorated with statuary under a (simulated) starry sky. Crawford's notes make reference to the context providing a particular interpretation of the work:

Staged in the Forum Theatre designed in the 1920s with the concept of a classical Roman heavenly garden, the gyrating human/ape hybrid will conjure a reinterpretation of the Garden of Eden and the beastly roots of mankind (Crawford 2014).

## **6.2 The Musical Body**

My second research question has been to do with technology and its place in understanding the internal body as a musical source of sound. This led me to undertake literature and Internet searches, and to make a visit to an ultrasound suite at a regional hospital<sup>1</sup>.

I learned from my reading, for example, that listening to the sounds of the body arose out of research by the French physician Rene Laennec, at the Necker Hospital in Paris in 1816 (Bishop 1980). Bishop, from the Cardiothoracic Institute at Brompton Hospital in London, has outlined how Laennec's discoveries led to the development of stethoscope listening for medical diagnosis and to the classification of body sounds of all types.

Sounds which can be accessed by this method are the sounds of the heart,

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<sup>1</sup> Diagnostic ultrasound imaging in medical practice uses sound waves in order to create images. It involves ultrasound waves (sound waves with a frequency higher than the upper limit of the human acoustic spectrum) being emitted by a hand-held transducer probe, which is held by the ultrasound technician against the body of the patient. The ultrasound waves are reflected back by living tissues. The physical characteristics of the tissue produce an alteration in their frequency (due to the Doppler effect).

This phenomenon allows the production of a visual image of the tissue which underlies the transducer, and in the case of blood flow in certain blood vessels, a sonic image. But it is important to note that the sounds produced in this way are not the actual sounds of blood flow but rather, are sonic images arising from the ultrasound process itself (Hagen-Ansert 2011).

respiration and gut. The development of the electronic stethoscope has meant that these sounds can be amplified in order to facilitate listening, although they are still usually heard in the conventional way, through the earpieces of the stethoscope.

It is within our experience that other parts of the body can produce sounds. For example, joints can be cracked to produce a popping sound, or arthritic joints can produce bony crepitus (a sensation of grating which is usually felt rather than heard, by placing one's hand on the joint being examined and moving the limb). The Canadian sound artist Christof Migone has produced a set of sound works titled 'Crackers', which use joint popping sounds as sonic materials (Migone 2005). However, his sounds were sampled from a series of volunteers and then used to construct a work, rather than recorded and performed live, which is my practice.

One can imagine that there may be other areas of the body which produce sounds which can be detected and amplified. Movements of the tendons of muscles over joints, of the individual fibers of muscles, and of blood flowing in blood vessels, for example, presumably produce sounds. However, my recording experience has led me to realize that both recording and reproducing these sounds are severely limited, due to the limitations of access and amplification.

Physiological signals in the form of electrical discharges, such as those occurring with the contraction and relaxation of muscle fibers, or with the

electrical activity of the brain, can be detected and amplified. Musically, for example, electrical brain signals have been sonified in live performance in such works as 'Music for Solo Performer', by the American electro-acoustic pioneer Alvin Lucier (Lucier 2011).

These considerations led me to focus my research on the sounds of the heart, breath and gut. It seemed likely that gut sounds alone would be complex enough sonically to sustain the project, certainly as described by the American psychiatrist and semiologist Peter Ostwald:

Among the internal organs of the body which make noises, the digestive tract is probably the most musical, a sort of miniature band. The mouth, a kind of trumpet, can hiss, blare and chomp. The oesophagus, like a bassoon, produces gulps, burps, and belches, which, when properly timed, can cause considerable hilarity. The stomach, akin to a French horn, gurgles, growls and groans. The intestines, resembling nothing so much as a glockenspiel, tinkle during peristalsis. The trombone-like colon zooms as it leisurely churns away at semi-solid gruel. Now and then its noises, especially the sudden, high-pitched beeps and bloops, embarrass the band director. Tuba like 'brummps' indicate the deposit of faeces in the rectum in anticipation of discharge to the accompaniment of a fanfare of noises (Ostwald 1973, p. 28).

### 6.3 Sonifying the Internal Body

A feature of my project has been its reliance on technology: the sounds of the body first need to be converted into an electrical signal and then amplified in order to be used musically, and the way in which this is done affects what is possible creatively. For example, if these technologies are portable, then the body can be recorded in different environments. But even if they are portable, recording the active, moving body may not be possible due to unwanted noise artefacts brought about by movement.



Figure 5: Documentary image from a breath sound recording session, using the Cardionics E-Scope II electronic stethoscope, in my home studio, 10 August 2013. Photo: Erwin Ebenreuter.

My initial recordings used a Cardionics E-Scope II electronic stethoscope (Cardionics 2014). This has the appearance of a conventional stethoscope and was designed for use in a medical clinical environment. An interface cable can be plugged into the body of the unit, which terminates in a mini-jack connector. This can be connected via a ¼ inch adapter into a computer interface and from there to the input of a computer, if sounds are to be

recorded directly into a software programme such as Logic Pro, or into the input of a digital recorder.

While this stethoscope produces an excellent signal for clinical purposes, the Operator's Manual emphasizes that ideal conditions are necessary for a good recording, which include a quiet room and a stationary patient (Cardionics 2010). It cannot easily be used for field recording since it cannot easily be attached to the body, and there is considerable noise artefact if the body is moving. Furthermore, it was designed with a battery saver feature: the unit switches off after a period of one and a half minutes unless the user presses the 'ON' button within that time, in which case it continues to operate again for the pre-set time. These limitations mean that while it can provide an excellent recording of body sounds, it can only be used for short recordings, that is, to provide samples for sample-based studio works, rather than for field recordings or performances. My searches for other brands of stethoscope revealed similar constraints.

At this time, I also conducted experiments in which I recorded my body sounds with a range of microphones. I tested a series of different contact microphones and several conventional microphones (a Shure SM 57, a Heil PR30 and Rode NT3). All had significant limitations with respect to this specialized use and were not able to produce a signal of reasonable strength without unwanted noise.

This led to me to search the World Wide Web for ways of modifying a stethoscope for recording body sounds, and discovering a YouTube video posting which outlined a low-cost approach to fitting stethoscopes with microphones for the recording of heart sounds, for medical clinical use (Bhaskar 2012).

I subsequently bought a number of Littman 3M Classic stethoscopes, and sourced lavalier microphones from the United Kingdom-based company Micronics (Micronic 2014). The microphones were supplied with 3 metres of cable, ending in an XLR plug. I had the length of the cable shortened by a technician, to 20 cm. I then cut the chestpiece of the stethoscope from the tubing going to the earpieces, leaving a few centimetres of the stethoscope tubing remaining, and inserted a lavalier microphone into the tubing.



Figures 6: Documentary image of the process of constructing stethoscope-microphones: the shortened lavalier microphones. Photos: Graeme Croft, 10 August 2013.



Figures 7 (top), 8 (bottom): Documentary images of the process of constructing the stethoscope-microphones: inserting the lavalier into the stethoscope chestpiece. Photos: Graeme Croft, 21 August 2013.

My method for using these microphones has involved ensuring firstly that the area of the body to which they are attached is shaven, since hair brushing against the diaphragm of the stethoscope chestpiece can produce noise artefact. I then attach one of the stethoscope-microphones to my chest near the position of the apex of my heart, and another to my abdomen in the upper abdominal region, to record heart and gut sounds respectively.

I have experimented with different types of tape and different ways of attaching the microphones to the body for maximal acoustic efficacy and



minimal skin irritation. 'Leukoplast' (smith&nephew 2014a)<sup>1</sup> initially worked well, although I later found that it was very irritant to my skin if worn for more than a few hours, and that 'Leukosilk' 2.5cm (smith&nephew 2014b), which is marketed as being hypoallergenic, caused considerably less irritation.

Amplifying lung sounds using a stethoscope-microphone applied to the chest wall is difficult in that the sounds are very faint. I also found that attaching the same microphone to the neck to capture tracheal breath sounds is not a workable alternative, in that it is difficult to secure and not practicable for use in a public setting. Instead, I use a contact microphone which is manufactured for beatboxing and sold as a 'Thumper' microphone (Feldman 2014)<sup>2</sup>. The microphone is supplied attached to a choker (worn around the neck) which is connected via a lead to the Thumper pre-amplifier unit (worn attached to the recordist's belt). From there the signal path is via a further lead to the digital recorder or computer interface.

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<sup>1</sup> This is a flesh coloured, zinc oxide tape available in 2.5cm and 5cm widths and sold in 5 metre rolls. It can be easily torn into strips of 20 cm or so. I use three pieces of Leukoplast or Leukosilk of about this length for each stethoscope-microphone.

<sup>2</sup> I became acquainted with this microphone at a performance given by a Melbourne colleague, Rosalind Hall, who used it for a similar purpose.

## 6.4 Exploring the Body in the Natural Environment

The availability of a method of continuous portable recording of body sounds led to a series of field recording works in which I recorded my internal body in a variety of environments.



Figure 9: Documentary image from the field recording session at Tolmie, Victoria, 15 September 2013. It shows my recording set-up at the time: a stethoscope-microphone taped to my chest to record heart sounds, and a second taped to my neck, for breath sound recording. I later replaced the neck microphone with the 'Thumper', and used an additional stethoscope-microphone taped to my abdomen for gut sound recording. Photo: Erwin Ebenreuter.

A major consideration in undertaking these recordings is that of managing the demands of the technology. Recording body sounds involves microphones attached to the body (as outlined). The two XLR outputs which emerge at

waist level are plugged into the recorder by cables, and the Thumper microphone (which is clipped around the neck), is plugged into the Thumper preamplifier unit and routed to a recorder by a further cable. To record environmental sounds, I initially used a Rode NT3 microphone located in a Rode 'Blimp' (a suspension windshield system used to minimize the impact of wind in field recordings). I later replaced the NT3 with a Rode NT4 stereo microphone, for stereo recording.

I use a Tascam DR-680 digital field recorder in conjunction with the microphones. For ease of recording, I carry all of the equipment (the recorder, cables, Thumper unit, camera and spare batteries) in a dedicated lap-top computer bag fitted with a shoulder strap, which I have modified with padding so that the recorder can fit more securely.

For a recording session in the city, for example, I attach the stethoscope-microphones to my body at home, then place the Thumper choker around my neck once in the recording environment, plug in the cables, obtain levels, take documentary photographs and then record.

After some experience, I found that the Blimp system was heavy, bulky and made this mobile recording process difficult. I experimented with other approaches, which included binaural recording using Soundman in-ear microphones (Soundman 2011), and a Zoom H4n compact hand-held digital recorder, which has inbuilt stereo microphones. My current preferred option is to use two digital recorders operating at the same time: the Tascam for body

sound inputs and the Zoom for environmental sounds, fitted with a Redhead windscreen (Prince 2014). I use a simple clapstick to synchronize the two sets of sound files.

There are many challenges faced with this type of recording activity. The need to manage batteries, memory cards, microphones, cables, signal levels, recorders and location issues, means that a recording session is demanding for the solo recordist<sup>3</sup>.

Recording the body while walking provides another example of these challenges, as evidenced by many of my early recordings in which there is considerable artefact coinciding with walking. As already outlined, my experience has been that even small movements of the body can produce a scratching noise in the recording due to body hair beneath the diaphragm of the stethoscope chestpiece.

But I also discovered that other artefacts can be produced by the effect of the walking body on both the heart and gut sound recordings, and that the heart recording in particular was often distorted. I conducted a series of recording experiments to examine the aetiology of this problem. My conclusion was that the force of the foot striking the ground creates a vibration which is transmitted through the body and is amplified by the cavities beneath the

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<sup>3</sup> A simple practical example is that the recordist has to keep track of the large number of batteries required for a recording session, which need to be freshly charged and fitted before each session. The Tascam recorder has eight AA batteries, the Zoom two AA, the camera has an internal battery and the Thumper has a nine-volt rechargeable battery, which I found may last for only an hour. Unless the session is short, a further set of batteries needs to be ready on standby.

microphones (the chest and the gut). This force also causes the skin to which the microphones are attached, to vibrate. In addition, activity causes the heart to beat with considerably more force and to consequently produce a louder heart sound. The end result is that unless the recording levels are set low at the beginning of the session, the (recorded) signal can peak and distort, or if the limiter on the recorder is used to manage peaking, can surge. The high sensitivity of the lavalier stethoscope-microphones may also contribute. As a result, I have found that an important element in the recording technique has been to record at a low level and rely on the recording detail provided by 24-bit recording to give a representative waveform.

### **6.5 The Internal Body and Instrumental Performance**

In order to undertake **live performances** of my body sounds, I developed a performance system which uses the same set of microphones as for field recording, as well as a multichannel Focusrite Pro 40 interface, an Apple Macintosh Pro computer, a Korg MIDI controller, a DBX graphic equaliser, a DBX compressor, and a six channel speaker system (four powered speaker boxes and two subwoofers).

For example, for a solo performance, the three microphone inputs (from the heart, breath and gut) are routed via the interface and computer to one of a series of computer programmes which I have written in the programming language Max/MSP. The programme provides for filtering of each body sound input, control of the output volume actuated by sliders on the MIDI controller, and routing of the signals to the four speaker boxes. The heart sounds are

dealt with as two streams: the first is treated in this way and the second is routed to external EQ and compression hardware and from there to the two subwoofers.

The performance practice is improvisational: the performer plays the sounds by using ordinary gesture or by changing the volume of the sounds with the MIDI controller<sup>4</sup>.

My initial experiments in improvisation as a solo performer led to three sets of collaborative works. In the first, I play my body sounds with another musician playing the flute, and in the second, play my breath sounds and contra-alto clarinet, with my musician colleague playing her breath sounds and bass flute. The third set of works is a body sound duet with another musician colleague, using our body sounds alone.

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<sup>4</sup> I discuss gesture and musical performance of the sounds later in this document (p. 46).



Figure 10: Image from the performance at La Mama Musica, Carlton, Victoria, 10 March 2014, with Belinda Woods (bass flute and breath sounds) and Graeme Croft (contra-alto clarinet and breath sounds). Graeme's 'Thumper' microphone choker can be seen along with the computer and road case containing the interface, external graphic equaliser and compressor. Photo: Erwin Ebenreuter.

Final developments have involved using field recordings as additional improvisatory materials, and the inclusion of the human spoken and singing voice in a further set of works.





Figure 11: Image from the recording session at Pughouse Studios, Thornbury, Victoria, 4 April 2014. Shows the performance set-up for the Body Sound Duet improvisation, with Ben Simmons. Ben's heart and gut stethoscope-microphones can be seen as well as the breath 'Thumper' microphone choker. He has the Korg nanoKontroller (sic) on his lap. Photo: Niko Schauble.

A significant technical issue with my performance system is that it is very sensitive to audio feedback. An important contributing factor is that the lavalier microphones used are omnidirectional and of high sensitivity. In addition, the amplitude of the body sounds is low so that considerable amplification of the signal is required to produce adequate output volume.

Another contribution may be from my arrangement of the speakers and the performers. I use four powered speaker boxes and two subwoofers; the



boxes are set up at the corners of a large rectangle, so that the audience can be situated within the space of the rectangle and the performers located centrally or along one side (and hence facing a set of speaker boxes). My rationale for this arrangement has come from my view that body sounds are quiet, internal and intimate: this configuration means that the audience members can be surrounded by sound, and involved in this intimate relation.

I have taken various approaches to managing feedback using this performance configuration. The body sounds are filtered (each sound is EQed as it enters the Max patch and the total sound output is EQed before it leaves the patch) and I have limited the amplification of the body sounds (although this obviously limits the sound output volume). I have also trialled using two speaker boxes rather than four and locating the performers behind, rather than facing, the speakers.

An additional approach has involved attempting to provide a degree of acoustic isolation of the heart sound in order to provide a louder heart sound before feedback. I obtained a sink plunger from a local hardware store, removed the handle from the rubber cup of the plunger and lined the cup with plasticine, with an indentation for the stethoscope-microphone. I also purchased a compressive elastic chest strap to hold the cup against my chest, over the microphone. Experimenting with this device has revealed that it is effective, although it seems possible that this may be the result of the firm pressure of the plunger against the stethoscope head optimizing its contact with the chest wall and hence optimizing the signal strength.

## **6.6 Instruments, Performance and the Conceptual**

As I have outlined, my two projects of field recordings and live performances have involved two realizations of the music of the body and the body as an instrument: one of the music of the body comprising the sounds of the body in its environment, and the other, of the music of the body comprising the sounds of the body being performed, and therefore including conventional musical ideas such as sounds being gestural, and the use of gesture to shape sounds.

My background as a musical performer probably contributed to the performance-based body becoming a focus for my project. As the project advanced, I began to view each body sound as instrumental and each organ system as a different instrument, so that in performing the body, the performer plays the three instruments (heart, breath and gut) simultaneously.

Each of the instruments is very different and requires its own musical technique. In performing the body, playing breath sounds is the closest to playing a woodwind instrument, in terms of gesture. For example, the performer can easily alter the loudness of the sound by varying the intensity of his or her breathing. A large dynamic range is achievable, from pianissimo to (an amplified) fortissimo. As with a woodwind instrument, varying the speed of the airflow and the shape of the throat can alter the timbre of the sound. The length of each sound or set of sounds can also be varied to achieve very short sounds (staccato) or smooth and connected sounds (legato).

In contrast, the gut does not resemble a conventional musical instrument and provides an unpredictable set of sounds. While gut sounds vary with gut activity, hunger and food intake, one is only able to alter sounds in a gestural and predictable way by changing the volume of the amplified sound. As a result, I came to think of gut sounds as being in the different instrumental category of 'soundscape instrument'.

The heart falls between these two instrumental types in that there is some opportunity for gestural control of sound output. For example, the Valsalva manoeuvre (the physical activity involving forced expiration against a closed glottis) increases intrathoracic pressure and reduces the venous return to the heart. This causes a reduction in the output of the heart and a consequent reduction in the loudness of the heart sound (Klabunde 2011). When the performer then relaxes and breathes normally, there is a sudden and transient increase in the loudness of the sound. Intense physical exertion (which is difficult to achieve during a performance) can also alter both the speed of the heart beat (tempo) and the loudness of the sound (dynamic range).

In performing the body, my approach has been informed by my improvisational style in previous musical projects, which has included free Improvisation, that is, improvisation without formal rules<sup>5</sup>. This seems to be a

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<sup>5</sup> The English improviser Derek Bailey has provided an excellent account of contemporary improvisational practices, including cross-cultural influences (Bailey, D 1992, *Improvisation: Its Nature and Practice in Music*, Da Capo Press, United Kingdom.)

reasonable performance and compositional approach with body sound materials, given their variability and complexity.

My approach has also been collaborative. I initially developed solo performances, but decided that the addition of other performers would add interest and bring the body sound works into a traditional musical context. As mentioned earlier in this document, the final works have involved duets with another instrumental performer (a woodwind performer playing the flute), duets involving both performers playing breath sounds and woodwind instruments<sup>6</sup>, a duet for two body sound performers, and a duet with a vocalist.

I have referred above to how the instruments which make up the body resemble or differ from more conventional instruments. But are there other commonalities or distinctions? Obviously, sounds of both the voice and conventional instruments are manifestations of the body. For example, a woodwind instrument can be thought of as being a transducer for the body in that it converts the energies and activities of the body into sounds through the breath, mouth, throat, hands and fingers.

While the voice and the sounds of the internal body are already present as sounds, the internal sounds need to be amplified in order to be heard and performed. The woodwind instruments and my microphones, amplifiers and

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<sup>6</sup> I chose breath sounds since they are maximally gestural, and since the other body sounds cannot easily be managed in performance along with a conventional instrument.

electronic equipment can be viewed as mediating the body and the sound object.

In a different vein, the English composer and theorist Trevor Wishart has studied sound objects in terms of their 'morphology', that is, the characteristics of the waveform of the sound, such as the attack and the decay of the waveform and how these parameters vary with different musical instruments (which he refers to as acting via 'imposed morphology') (Wishart 1996, p. 178).

However, if the morphology of the sound object is considered more broadly to be its form and structure, then the waveform is only one representation of morphology and there are presumably others. For example, morphology can be thought of as the ways in which the form and structure of the sound object mirrors the form, structure and activity of the object from which it has been derived. In the case of the body, the morphology of the breath sound object is a representation which comes out of the flow of air in the lungs and trachea, and the physical structure of the organs and spaces involved. Using a similar principle, the heart sound object is a representation of the heart, including its internal chambers, valves and activity.

If morphology is thought of in this way, Wishart's notion of imposed morphology is still relevant in the case of the flute, in that the sound object produced by the flute mirrors both the structure and function of the body, and the shape, structure and activity of the flute. The point of departure for the

flute from the body is evidenced by the particular additional ways in which the flute manifests its imposed morphology.

Finally, I would like to refer to the work of the French philosopher and semiotician Roland Barthes. In elaborating his idea of the 'grain of the voice', he writes:

Listen to a Russian bass.....: something is there, manifest and stubborn (one hears only that), beyond (or before) the meaning of the words, their form (the litany), the melisma, and even their style of execution: something which is directly the cantor's body, brought to your ears in one and the same movement from deep down in the cavities, the muscles, the membranes, the cartilages, and from deep down in the Slavonic language, as though a single skin lined the flesh of the performer and the music he sings. The voice is not personal: it expresses nothing of the cantor, of his soul; it is not original (all Russian cantors have roughly the same voice), and at the same time it is individual: it has us hear a body which has no civil identity, no 'personality', but which is nevertheless a separate body. Above all, this voice bears along directly the symbolic, over the intelligible, the expressive: here, thrown in front of us like a packet, is the father, his phallic stature. The 'grain' is that: the materiality of the body speaking its mother tongue; perhaps the letter, almost certainly signifiante (sic) (Barthes 1977, p. 181).

In considering my project, it seems reasonable to maintain that whether one performs with the voice or with the instruments of the body, what is performed and heard is 'the materiality of the body, speaking its mother tongue'. The body is the commonality and what is revealed goes beyond waveforms to the individual and to cultural essence itself.

### **6.7 A Consideration of Three Perspectives**

As my project progressed, I began to consider what I was undertaking in terms of three perspectives: the perspective of the **field recordist**, the **performer** of body sounds, and **the listener** to works.

For example, my experience as a **field recordist** involved thinking about authenticity in relation to the recording and editing process, and the agency of the recordist. My experience as a **performer** led to ideas about the sonic image of the body in performance, about body boundaries and the performance of body sounds, and about musical gesture as it applies to body sounds. My experience as a **listener** involved considering how body sounds may provide a frame for listening or may humanize the listening experience.

As an example, I would like to discuss in greater detail what arose out of a listening project. By way of explanation, the process of producing a sound file for listening from my field recordings involves taking the five files recorded at the time (heart sounds, gut sounds, breath sounds, a left soundscape channel and a right soundscape channel), processing each individual file in order to optimize the sound, and then mixing each file to make a final file which can

bounced as a permanent stereo file<sup>7</sup>. In the mixing stage, a major set of decisions is to do with the loudness of each individual file in relation to the other four files.

My listening project involved listening to the same final sound file which was mixed according to three different conditions: the first, with the body sounds very soft in comparison with the environmental sounds, the second with the body sounds very loud in comparison, and the third, with the body sounds and the environmental sounds being of equal loudness. I used my recording number 255 made at 8.30pm on the 31<sup>st</sup> January, at a property in Tolmie (near the country town of Mansfield in Victoria) as sonic materials. I have included the three mixes in my physical documentation of this project (Disc 2, p. 106).



Figure 12: Documentary image from the field recording session at Tolmie, Victoria, 31 January 2014, for recording 255. The recording was made at the rain gauge pictured. Photo: Graeme Croft.

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<sup>7</sup> If I use the Zoom recorder for the soundscape files rather than the Rode NT4, there are effectively four files (three mono plus a stereo).



- **First mix**



This is an expansive and rich natural soundscape in which sounds seem multilayered. The recordist's body sounds feature at the start, albeit quietly, but become quieter again as the recording progresses. This is not due to editing: in mixing the files, I set the volume levels for each track and did not automate volume changes. The prominence of the body sounds at the start may seem a little puzzling, but the listener's interest is transferred to the noise of a car and to the nature soundscape, with birdsong and a buzzing blowfly providing a changing background and foreground, and cicadas contributing drone-like sonic elements. The distant sound of the opening of a car door, a distant female voice apparently in conversation, and the noise of a car being driven along an unmade driveway add a human presence. At times, the sounds of the blowfly and birds are very prominent and contribute a distance perspective: through one's knowledge of the origin of the sounds and their relative natural volumes, the noise of the blowfly in particular, helps to locate the position of the recordist in the space.

One can hear the body of the recordist in quiet breath sounds, heart sounds, and from time to time, gut sound crackles, along with occasional movement noises. The recordist is at times more noticeable than at other times: more obvious, for example, when the breath sounds coincide with focussed sound events, and less so, when the heart slows towards the end of the recording and is less intrusive.

Without an explanation, the presence of the human body sounds may be experienced by the listener as unusual or odd. However, they are not disturbing or anxiety provoking and the body of the recordist is relatively unobtrusive: present but almost out the picture.

In examining this mix, I would like to introduce the concept of 'Point of Audition' (POA). This has been discussed by the French composer and filmmaker Michel Chion in relation to audition in film, and also has application to audition in sound works (Chion 1994). According to Chion, there are two types of POA: subjective POA, in which the viewer experiences the inner world of the character, and spatial POA, which refers to the location of the listener in the spatial field. However, he makes the point that in contrast with visual perception, aural perception does not always permit a specific location for sound, and that it may be more realistic to think in terms of audition having a 'place' or a 'zone'. He also emphasizes the importance of the combination of visual image and sound in arriving at a POA:

A special case in point is one defined by sounds that 'don't carry', supposedly of such a nature that one must be right up close in order to hear them. Upon hearing these sounds or indices of proximity (e.g. breathing in a voice) the spectator can locate the point of audition as that of a character in the scene, provided of course that the image, the editing and the acting all confirm the spectators hunch (Chion 1994, p. 91).

I mentioned earlier the shift in my thinking about my research: that it is not only about body sounds, but is about the body (Project Proposal, p. 23). What follows is that some of the language which I have used in understanding what is happening in my mixes may not take important considerations into account simply because the language of the body is not so clearly describable. My analytic perspective involves my mind articulating what I hear: but what my body hears and perceives may be quite different. As the French philosopher Merleau-Ponty has stated:

We have relearned to feel our body; we have found underneath the objective and detached knowledge of the body that other knowledge which we have of it in virtue of its always being with us and of the fact that we are our body (sic). In the same way we shall need to reawaken our experience of the world as it appears to us in so far as we are in the world through our body, and is so far as we perceive the world with our body. But by thus remaking contact with the body and with the world, we shall also rediscover ourselves, since, perceiving as we do with our body, the body is a natural self and, as it were, the subject of perception (Merleau-Ponty 2002, p. 239)

In returning to my first mix: it appears that the POA is within the zone of the soundscape but is made more challenging by the lack of any visual image. But what is the effect on the listener (if any) to hearing body sounds in a recording if the listener knows that the sounds are those of the recordist? In

undertaking this research, the ideas of the American philosopher Drew Leder, as expressed in his book 'The Absent Body' (Leder 1990), have been helpful. Leder has a contribution to this question in terms of 'gaze':

In addition to this coesthetic awareness, we have access to multiple modes of self-observation mediated by outer-directed senses. I can employ the reflective surfaces of the world: mirrors, bodies of water, photographs etc. The gaze of another also initiates self-reflection. I apprehend myself as embodied and defined when I look into the eyes of another looking at me (Leder 1990, p. 23).

Leder is talking about gaze in the visual dimension. But what if we imagine a notion of gaze as it may apply to the sonic dimension? It seems possible that the listener may experience the sounds of the body of the recordist as a type of sonic gaze of the recordist (within the soundscape). Perhaps this may lead to the self-apprehension and embodiment to which Leder refers.

A further approach to thinking about this mix arises from the work of the French philosopher, urban planner and musicologist Jean-Francois Augoyard and his colleague, the sociologist and musician Henry Torgue, at the Centre for Research on Sonic Space and the Urban Environment (CRESSON), in Grenoble. They identify and discuss eighty-two sonic effects, one of which is termed the 'Repetition Effect' (involving the outcome

of repeated sound events). They make reference to this effect in relation to body rhythms:

The repetition effect is a constitutive factor of our perception of the world. Our consciousness of bodily rhythms such as breathing or heartbeats makes us aware of the necessity of repetition that also marks physiological time. Bodily cycles that have sound manifestations punctuate biological life by expressing its formal framework and thereby establishing a perception of reference (Augoyard & Torgue 2005, p. 93).

It seems possible that the distant heartbeat and breath sounds of the recordist introduce the dimension of time into what may otherwise be experienced as unbounded.

- **Second mix**



The thump of the heart is insistent from the outset and is rapid, as though the recordist is a little out of breath. The sounds can almost be felt: it is as if one is close to the heart and surrounded by breath sounds, with occasional loud crackles from the gut, swallowing noises and other bodily tremors. The environmental sounds blend into a background: what sounded like separate bird sounds in the previous recording are for much of the time heard as continuous, along with the cicadas. But the buzzing of the blowfly is very distinctive, except that now its connection with the recordist (that it is flying near the recordist) is not at all clear.

My experience (as the listener) is that it is as if the listener inhabits the body of the recordist. The listener may also be curious about what the body is doing and thinking: surely it cannot be just listening and recording? In this mix, the POA is that of the recordist. A conclusion from this mix is that the presence of vision is not always required to establish the POA, and that the recordist's sounds alone can be so insistent that the listener feels as if they inhabit his or her body.

The idea of inhabiting the body of another is of great cultural interest and can be found, for example, in a number of popular films. In 'Invasion of the Body Snatchers', extra-terrestrials replace citizens of a small town with doubles who are identical but who lack emotion (IMDb 1990). The film 'Harry Potter and the Chamber of Secrets' involves Harry and his friends Ron and Hermione drinking 'polyjuice potion', which transforms Harry and Ron into their enemies Crabbe and Goyle (Rowling 2010). A further example is with the character Jake Sully, in the movie 'Avatar'. Sully is a United States marine, and is paraplegic. His mission on the alien world Pandora involves occupying an avatar body and undertaking extreme physical feats which contrast with the limitations which he experiences due to his disability (IMDb 2009).

But what is the relation between the occupying body and the body being occupied? In 'Invasion of the Body Snatchers', the body is simply a container for the alien. The case of Harry and Ron is similar: their sense of personal identity is maintained and is not affected by their new embodied position. In

Scully's case, his avatar body provides him with a new reality and a new experience of himself. In my listening example, a listener will have no doubt that he or she is continuing to inhabit his or her own body: it is not as though the boundaries of the listener's body have broken down. But subjectively, a listener may experience himself or herself as if within the body of another, sharing the embodied experience of the recordist.

My preference is to think of this phenomenon as not simply to do with body boundaries and body spaces (as in the film examples) but rather in terms of what Leder calls 'mutual incorporation'. This is to do with what happens to the experience of oneself in the presence of another:

In an even more radical way we supplement our embodiment through the Other.... (sic). Through a natural empathy, one body takes up the affective responses of another. I feel sadness as I witness another's tears and am infected by his or her laughter. There is a further transmission of intentions allowed by the use of gestures and language. In mutual incorporation, each person's capacities and interpretations find extension through the lived body of the Other (Leder 1990, p. 94).

It is possible that the emotional experience of the listener is not only due to their POA (the body of the recordist), but also to being transported into a particular experience of themselves in which their world is extended beyond

their ordinary boundary, through the experience of another. It is possible too that the unexpected nature of this experience catches the listener by surprise.

- **Third mix**



In this mix, I have tried to present each set of sounds (of the external and internal soundscapes) with equal authority, so that no particular set is privileged over the other. A major feature of this sound field is how the sounds compete for attention. It makes for confusing listening: cries of individual birds can again be heard separately, rather than as a low background hum. But confusingly, along with the blowfly noise, they are at times as loud as the breath sounds. This means that loudness cues, which due to the listener's knowledge of the source of the sound assist in locating the listener within the space, are no longer helpful and are even confusing. The coherence of the sonic topography is disturbed.

One viewpoint could be that this lack of coherence results from the internal and external sets of sounds (the body sounds and the environmental sounds) each competing for the listener's attention, so that there are two points of audition. But this recording is more complex: as the recording progresses, the heart sounds shift from being somewhat emphatic and rapid at the start, to being slower and less prominent. This shift has a major impact on the listening experience. Early on, it seems that while the heart sounds and respiratory sounds are distinctive in the presence of the other sounds, they do not necessarily cohere into a sonic body. The gut sounds contribute to this



failure, in that they are sufficiently unfamiliar and strange in terms of the usual listener's sonic experience so as not to be heard as part of a human body.

My experience is that if I listen to these body sounds naively, I can hear them as elements of some type of external soundscape. But as the recording advances and the heart sounds undergo their shift in timbre and volume, the distinction between the internal and external worlds somehow becomes clearer.

One listening option for this recording is to attempt to listen acousmatically, that is, to the sounds without thought as to their origins. A problem with this approach is that most of the sounds are very distinctive: it is difficult to prevent oneself from focussing on and identifying the source of each sound. A second problem for listening is that it is as though something is happening, that this recording is 'about' something: there is a particular text. Furthermore, I have wondered if my lived body (to which I referred earlier in my quote from Merleau-Ponty) privileges the sounds of humans over other sounds, both animate and inanimate.

In the first half of the recording, my listening experience is of a sort of sonic chaos and lack of cohesion. There is no POA. Sounds are heard but not located. How can one theorize about this sonorous space? It appears possible that it is a version of Augoyard and Torgue's 'Ubiquity Effect'. This is described as a difficulty or inability to locate the source of the sound: 'In the major variant of this effect, the sound seems to come from everywhere and

from nowhere at the same time' (Augoyard & Torgue 2005, p. 130). The authors emphasize that the Ubiquity Effect requires the listener to be unable to localize the sound but to have a need to determine its location. It appears that this combination of the lack of a location and the need for a location can result in feelings of anxiety or even panic in the listener.

In the second half of the recording, the POA is a little clearer. However, it seems to be neither the body nor the environment: the two are somehow superimposed. As the English scholar Steven Connor writes in the Oxford Handbook of New Audiovisual Aesthetics:

Sound is intrinsically mobile, taken up anew in different ways according to different kinds of hearing situations, different points of view --- or 'points of audition' (Connor 2013, p. 107).

I suspect that the challenge in listening to this part of the mix is not simply due to the mobility of the sounds, but results from there being two listening perspectives, both which are unstable. It seems possible that a listener who is more strongly influenced by a description of the context may find it easier to make these sonic distinctions.

But what does it mean that the body of the recordist can be perceived in the ways which I have outlined, in my three mixes? Are they simply artefacts

created out of the possibilities of modern recording technologies and processing?

The Dutch ethnographer Annemarie Mol explores how objects can be understood as being created through enactment, in her book 'The Body Multiple: Ontology in Medical Practice'. Her research is based on fieldwork in several hospitals, focussing on practices and experiences to do with the disease 'Atherosclerosis'. She writes:

If practices are foregrounded, there is no longer a single passive object in the middle, waiting to be seen from the point of view of a seemingly endless series of perspectives. Instead, objects come into being --- and disappear --- with the practices in which they are manipulated. And since the object of manipulation tends to differ from one practice to another, reality multiplies. The body, the patient, the disease, the doctor, the technician, and the technology: all of these are more than one, more than singular. (Mol 2002, p. 5).

This investigation of mixes and soundscapes and my research itself is also about the body and its enactments, about what Mol has referred to in her research, as 'an intricately coordinated crowd: the body multiple' (Mol 2002, p. viii preface).

- **Acousmetre and Body Sounds**

In my discussion of the second mix, in which the recordist's body sounds are more prominent, I have suggested that the listening experience is one of being inside the body of the recordist. A further possibility is to do with Michel Chion's notion of 'acousmetre'. This concept refers to the voice in film, when the face of the person producing the voice cannot be located.

When the acoustic presence is a voice, and especially when this voice has not yet been visualized --- that is, when we cannot connect it to a face --- we get a special being, a kind of talking and acting shadow to which we attach the name acousmetre (Chion 1999, p. 21).

He suggests that the acousmetre is an intimidating magical presence, in that the voice is then experienced as being able to 'be everywhere, to see all, to know all, and to have complete power' (Chion 1999, p. 24).

My reason for referring to the second mix is that I have wondered if the body which is heard there could be perceived in this way, that is, whether the listening experience could be of a body which is omnipotent, alienating and threatening, rather than incorporative and expansive. But I also appreciate that the experience of acousmetre may not have direct application to recordings: it may only apply to a voice and not to an acoustic presence which is experienced through the internal sounds of a body.

The Norwegian art historian Tina Rigby Hanssen has discussed acousmetre in the context of Canadian sound artist Janet Cardiff's use of her whispering voice in her recorded soundwalks (Hanssen 2010). Hanssen suggests that while Cardiff's voice has some qualities of acousmetre, such as a sense of closeness and a difficulty in being located in space, Cardiff's engaging conversational style disrupts this perceptual view. Her opinion appears to be that it is the overt relational use of the voice which is critical to this disruption.

I would assume that establishing an acousmetre in a recording in the case of body sounds would require the sounds firstly, to be able to signify a human body. It seems likely, for example, that gut sounds are too unfamiliar to be consistently heard as belonging to a body, so that only heart and breath sounds could function on their own in this manner.

Secondly, I imagine that as Hanssen has suggested, there is a particular type of engagement with the acoustic presence which is important: perhaps in my second mix, a positive experience of the environmental context may draw the listener additionally into a positive experience of the body of the recordist, in a similar way to Cardiff's voice in her work. Presumably, a context in which the listener does not realise that the body is that of the recordist and feels threatened by and subject to the body, would be more likely to lead to the experience of acousmetre. This could be a fruitful subject for further research.

## 7. Final Comments

My research project has been interesting and rewarding on many levels. It has required taking the time to listen, see and experience the world deeply, and to have encounters with people and situations which would have never otherwise been possible. I would have been unlikely, for example, to travel into the city, produce a camera to document the environs, and then walk along a main thoroughfare with cables emerging from my body into a computer bag carried over my shoulder. I would not have found myself creating music with my body sounds, along with a bare-chested colleague who was similarly engaged.

Most significantly, an unexpected outcome has been a new appreciation of sound and beauty. This has arisen in various ways. For example, I have not yet described, in writing about my soundwalks, how I walk. This is important. The walk is not at a confident brisk pace. Rather, it is slow, measured, self-conscious, considered and even painstaking. I am cautious about jolting my bag, the cables and the microphones, and careful to avoid obstacles in my path. I can be hesitant, and at times may stand stationary for a few seconds or a minute before moving on.

I have thought about my walking as a type of improvised performance, involving my body and its internal and external sonic worlds. But a feature of the walk which I would like to emphasize is the type of listening which is a consequence of the walk. It is difficult to describe: my conscious state is focused and almost meditative. My experience is as if I am operating in slow

motion, listening intently to sounds as they occur. An outcome which has perhaps been inevitable has been a new appreciation of sounds and of the disjunctions between the sonic and the visual. The walking has awakened my perception of beauty and in particular, the beauty of sounds of many types.

I have also spent many hours engaged in a more matter-of-fact type of listening to internal body sounds. Not surprisingly, the internal sounds of my own body have become very familiar to me. Early on in my research, I read Ostwald's description of the sounds of the gut (Project Proposal, p. 32). He wrote about the gut as if it was a sort of comic orchestra. But the writing of the French philosopher Julia Kristeva led me to wonder whether amplifying my internal body sounds meant them occupying the in-between social space of the abject (Kristeva 1984, p. 4).

In fact, my experience has confirmed neither of these perspectives. In my listening, I have discovered that both heart sounds and breath sounds are emotionally evocative for different reasons (Project Documentation, p. 83). But my response to bowel sounds has been a particular surprise. I have heard them as I hear the tinkling, gurgling and splashing of water in a stream: their unpredictability, variety, timbral qualities and consequent associations have brought about an experience of surprise and even delight. It appears likely that the amplification of these sounds is not in fact experienced as a breach of a boundary, so that they remain internal. In any case, for me, internal body sounds have reshaped my notion of the aesthetics of beauty and the beauty of what otherwise may be overlooked.

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14. The Body, Improvisation, and Contra-Alto Clarinet (excerpt), 15 October 2013, (01:29:12).
15. Bass Flute and Breath Sounds (Belinda Woods), and Contra-Alto Clarinet and Breath Sounds (Graeme Croft), 19 March 2014, (07:18:22).
16. Body Sound Duet (Ben Simmons and Graeme Croft), including soundscape material from a soundwalk at the Cheviot Tunnel, Yea, Victoria, 31 January 2014. Recorded 9 September 2014 (07:12:34).

## **Disc 2: A Consideration of Three Perspectives**

### **File**

1. First Mix, Soundwalk at Tolmie, 31 January 2014, (02:43:74).
2. Second Mix, Soundwalk at Tolmie, 31 January 2014, (02:43:74).

**3.** Third Mix, Soundwalk at Tolmie, 31 January 2014, (02:41:70).

# Documentation of the Project

## 1. Introduction

The sound works Included here evidence the evolution of my project. I have ordered them according to the development of my ideas, which does not fit into a sequential timeline, since I revisited ideas as I learned more about recording and performance technologies. I have discussed these developments in the Proposal section of this document and have included references to the relevant page numbers in the Proposal, where this may be helpful.

By way of explanation, my practice is improvisational and performance based. This has meant that most works do not have a formal plan or score. In addition, my compositional perspective is that most of the works are intended for a live performance setting (which includes the bodies of both the performers and listeners) and have not been created for recording and reproduction. The purpose of the recordings is to document performances and my creative development.

It is important that the listener is aware that the heart sound recordings are of a low frequency, of the order of 60Hz. In order for the works to be heard as intended, they require headphones with an excellent low frequency response, or reproduction via a sound system with a subwoofer. In listening to and editing this material, I have used Sennheiser HD 280 pro headphones: the works are likely to be heard most reliably through a similar set of headphones.

This applies particularly to the three files on Disc 2, which are the basis for the discussion 'A Consideration of Three Perspectives' (Project Proposal, p. 51).

Although my account is at times in the third person, unless otherwise stated, the body recorded and performed is my own, and I am also the instrumental performer and recordist.

## 2. Exploratory Works

### 2.1: Body Sound Suite, 31 August 2013.

**File 1: Soundscape of the Heart, (01:18:57).**

**File 2: Breath Soundscape, (01:23:17).**

**File 3: Soundscape of the Gut, (01:24:64).**



These initial recordings are of the **soundscape of the internal body**, focussing on the heart, breath and gut. They were recorded with a Cardionics E-Scope II electronic stethoscope, via an interface and computer, using Logic Pro.

In examining the sounds of the natural body, my recordings reference works which focus on the natural soundscape, such as the ‘The Sound Map of the Hudson River’, in which the New Zealand-born American composer Annea Lockwood explored and documented the sonic world of the Hudson River in New York State (Lockwood 1989 and 2003). They also reference the American composer and sound artist David Dunn’s examination of the internal sound world of the pinyon pine tree ‘The Sound of Light in Trees’ (Project Proposal, p. 25).

My findings have included the realization that it would be unusual to hear only a single type of body sound in a recording. Additional sounds are usually present, such as:

- sounds due to small movements of the body of the person who is being recorded,
- other internal body sounds from adjacent organs (such as gut sounds in a recording of heart sounds), and
- sounds external to the body, such as room sounds.

As a result, the recordist needs to make an aesthetic decision about what additional and possibly unwanted sounds are acceptable in a recording. I have discussed earlier my approach to the artefacts which can occur with walking (Project Proposal, p. 40). But I have generally taken the view that additional sounds are manifestations of the body and its environment, and have a legitimate place in a recording.

What also became clearer in making these recordings is the nature and behaviour of body sounds: heart and gut sounds are automatic, whereas breath sounds are both automatic and under voluntary control. My experience has been that breath sounds appear to be much more capable of communicating emotion; perhaps this is due to their direct connection with volition, the fact that they communicate across both internal and external spaces, and their timbral quality and cadence.

Despite heart sounds being generally regular and having a more remote, machine-like presence, they too can be experienced as being affectively evocative.

My hypothesis is that this arises for quite different reasons from breath sounds, namely, due to the representations which they trigger. As can be heard, gut sounds, with their tinkles, gurgles and splutters, provide a very different version of the internal sonic body.

## 2.2: Household Object Improvisations

**File 4: Improvisation for Paper and Heart Sounds, 2 April 2013,**  
**(01:52:71).**



This set of works arose out of initial experiments **integrating heart sounds and performative elements** using minimal materials.

I created a longer looped file from a heart sound recording, played it through speakers and recorded a series of improvisations in my home kitchen/living space, using household objects: a toaster, electric mixer, electric kettle, can opener, cutlery, and saucepans. Street and traffic sounds intruded, and I subsequently made other recordings including this set, by listening to the loop over headphones while recording the close-miked improvisation, and then producing a stereo mix in Logic Pro.

The works were influenced by Pierre Schaeffer's 'Etude aux Casseroles' from his 'Etudes de Bruit' (Schaeffer et al. 2009) and by John Cage's 'Variations VII' (Cage 1966), in which he included kitchen appliances amplified with contact microphones, as sound-producing objects.



The works explore how sounds other than those of the body can be combined expressively with heart sounds.

Each of the sounds in these recordings is effective in different ways, for different reasons. Timbrally, the paper noises and can opener sounds seem more integrated with the heart sounds than the cutlery and toaster sounds, perhaps to do with their frequency range.

A particular feature is that the household sounds evidence the activity of the gestural, volitional body and contrast with the internal automatic nature of the heart sounds.

### **2.3: Phasing Investigations**

**File 5: Heart Sound Study, 9 September 2013, (04:05:19).**



My original interest in this research project arose in part out of learning about the use of phasing in works by the American composer Steve Reich, such as 'Clapping Music' (Reich 2005) and 'Music for Eighteen Musicians' (Reich 1978). Reich used simple rhythmic motifs which were initially synchronous and then displaced in time, to create different phasing effects. The most rhythmic of all body sounds, the heart sound, seemed an obvious resource for this type of composition.

The phasing studies involved **transforming the heart sounds without any processing** of the sounds themselves. I experimented with different approaches to phasing, including recording the same sound into buffer objects in Max/MSP and then displacing the start of each file. In the end, it seemed simplest to record a single file of heart sounds and then to overlap multiple copies in Logic Pro to create short works. I panned each of the files within the piece separately, in order to provide each file with its own place in the sonic field. However, this may not be obvious, in that heart sounds, which are the predominant sound in each file, are difficult to localise in space due to their low frequency.

What I discovered in the works was an acousmatic transformation of the sounds: initially the sounds are heard as heart sounds, along with background gut sounds. As the piece progresses, the perception of the heart sounds changes to short, frequent, low-pitched, explosive noises of various intensities. Towards the end of the piece, as the layering is reduced, the perception of the sounds as heart sounds is restored.

The background gut noises also change: they begin as occasional random sounds, but then join to create their own significant texture, to such a degree that the listener may experience an attentional shift, from one sound type to the other.

## 2.4: Body Sound Processing

**File 6: Modified Heart Sounds in Max/MSP, 6 May 2013, (01:14:23).**

**File 7: Modified Heart Sounds, White Noise and Environmental**

**Sounds, 6 May 2013, (01:17:21).**



These works arose out of explorations in which **I processed sounds in order to change the identity of the sound** and to expand its sonic palette.

Using a heart sound sample, I made a Max patch which allowed me to speed up or slow down the sample and to record the result. I recorded the file at nineteen different speeds, from 0.14 times the original speed, to 300 times. I discovered that when slowed down, the sound could be still heard as a heart sound. In contrast, at three times the original speed, it lost its character and became more tapping and rhythmical; at ten times the speed, it sounded like the cracking of nuts; at seventy times, it was continuous and drill like, and at three hundred times, it was heard as a continuous sound at one pitch, with shimmering overtones.

I next chose five timbrally contrasting files, edited their length, and made a simple file player in Max/MSP using five sf players and five metro objects, set at different rates, to trigger files. I panned each player separately. The first group of improvisations was created out of triggering these sounds by switching the metro objects on and off in real-time.

In a second set of pieces, **I explored the effect of the addition of white noise and sounds from the Australian landscape.** I added a noise object and a further file player to the original Max patch and loaded the player with a recording which I had made several years ago at a property in Tolmie, in country Victoria, in which I had improvised by striking the wire fence<sup>1</sup>. Incidental external sounds, such as birdsong, were also included in that recording. This second set of pieces was created in a similar way to the first, using the original five files and these new materials.

## **2.5: The Territory of the Body**

**File 8: Gut Sounds Study, 24 April 2014, (03:02:66).**



Reading the semiologist Peter Ostwald's description of gut sounds and their great variety (Project Proposal, p. 32) led me to realise that each sounding area of the body, that is, the heart, the respiratory system and the gut, could be thought of as a territory with its own complex sound world. My approach to recording had been to take a single recording of a location within a territory, and to have this represent the whole. The idea for this work was to **investigate a specific sonic territory within the body.**

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<sup>1</sup> I had been interested in the work of the Australian musician John Rose and his study of the sounds of wire fences, as described by the American violinist and composer Hollis Taylor in her book about the journey which they undertook into the interior of Australia (Taylor 2007). Taylor referred to playing fences as revealing 'a sound world that is embedded in the physical reality and psyche of our culture' ((Taylor 2007, p. 3). When considering my project, I began to think about wire fences as a sort of neurovascular organ system within the body of the Australian continent, connecting otherwise distant and apparently disparate parts of the organism.

I did this by recording the gut using four microphones located at different vantage points on the abdominal wall (in the right and left upper quadrants and the right and left lower quadrants of the abdomen). I panned each file separately in mixing to reflect its geographical location.

While the recordings reveal the diverse activity and sounds within this territory, both these recordings and Ostwald's description have emphasized that the duration of the recording would need to be extended significantly to provide a more complete account of its sonic world.

## **2.6. Containing and Elaborating the Body in Time**

**File 9: Juxtapositions, 19 August 2013, (04:55:55).**



'Juxtapositions' arose out of the idea of **investigating the body in time** rather than in space. It was influenced by two contemporary works, the first 'Les Archives du Coeur' (Benesse Art Site Naoshima 2014) by the French artist Christian Boltanski and the second, 'The Forty Part Motet' (Cardiff & Miller 2014) by the Canadian sound artists Janet Cardiff and George Bures Miller.

Boltanski's piece addressed the transient nature of human life, and involved making recordings of the heart sounds of thousands of participants, with the plan to store them in perpetuity in a type of sound mausoleum, located on an island off the coast of Japan.

Cardiff and Miller used the motet 'Spem in Alium' by the 16<sup>th</sup> century English composer Thomas Tallis, as source material. The motet has forty separate parts, each for an individual singer, and is normally performed conventionally as a choral piece. However, Cardiff and Miller arranged for the parts to be recorded individually and each played through its own powered speaker in a large performance space. This meant that if the listener stood close to a speaker box, a single part could be heard, highlighted in relation to the others. Alternatively, if the listener located himself or herself centrally, he or she could hear the work as a whole.

Boltanski's work led me to think about life and mortality, and how the experience of living can be thought of in terms of a succession of brief moments of one's life being lived and then lost. 'Les Archives du Coeur' involved preservation of what would ordinarily have been ephemeral and lost without thought.

'The Forty Part Motet' provided a model for presenting a large number of parts of a sonic whole so that each could be heard individually, or integrated to be heard as a total work. My idea for a work was based around recording a series of brief moments in my life, so that they could be heard singly or together. The intention was for the recording of each moment to involve my body, as represented by my heart sounds, and the articulated experience of my body, as narrated by my voice.

The plan was for a multiple-channel piece for twenty-four powered speakers, and involved a recording diary in which I would record a sample of my heart sounds along with my voice talking about my subjective experience at that time, each day over twenty-four days. The intended work involved playing the heart sound and text on one powered speaker, which would fade into a background and be looped. The sounds and text for the next day would then be played on another speaker, which would then fade and be looped as the third, fourth and so on, were played. The recordings would together create a sonic representation of mortality, life and loss. The work would capture and contain aspects of the ephemerality of the body and its experience.

This recording is of a trial piece, covering only four (non-consecutive) days. As outlined, each daily record has two recordings, of heart sounds and narrated text. I wrote a performance programme in Max/MSP which allows the performer to trigger the text and heart sounds, which when played, fade automatically to a lower volume and loop. The recordist can then trigger the next set of sounds and text.

Working on this piece was interesting in terms of developing a conceptual, multi-channel work in the style of an installation, in which the sonic image was manifest not only out of internal sounds, but also out of the more expansive, social body.

### 3. The Body in the Natural Environment.

This is a large set of works which explores the body and its internal body sounds in different natural spaces. My perspective is of the recordist as an improviser, who expresses his or her musical agency through the choices made in engaging with the place.

**File 10: Soundwalk at Tolmie, 15 September 2013, (02:10:58).**



This recording is from a property in Tolmie (a small town near Mansfield, in country Victoria). It was one of the earliest of my field recordings, and involved an **exploration of technical issues**, such as how to record the body, the limitations of the stethoscope-microphone in recording breath sounds, and recording the body in motion. It also involved **learning about how the body interacts with and articulates the environment**.

In this recording, the body can be heard, for example, in the noises of effort in breathing, in the heart rate changing with effort, in the noise of feet on stones and grass, and in other sounds of activity. The movement of the body can also be appreciated through changes in the sound field: for example, the noise of the bees becomes louder and softer as the recordist moves towards or away from them. The recording also highlights the dimensional nature of representations of the body, in that it features the sonic body, and provides few clues as to, for example, the visual or the affective body.



**File 11: Soundwalk at the Cheviot Tunnel, Yea, Victoria, 18 April 2014, (05:00:14).**



This work examines the body in the Australian landscape but also in an historic Australian location: the Cheviot tunnel, a railway tunnel built in the late 1800's for the now-closed Yea to Molesworth railway line in country Victoria. The soundwalk began about 10 metres inside the tunnel, at the Mansfield end, and ended just outside. It was an **exploration of the body in a reverberant space**, in which these dynamics changed in the course of the walk. The reverberation of the external sounds of the body in the space can be heard as another sonic manifestation of the body in its environment. It is also interesting how very subtle changes in heart rate can be heard arising out of the effort of walking.

**File 12: Soundwalk along Spencer Street, Melbourne, opposite the Great Southern Hotel, 24 April 2014, (04:21:37).**



This recording was **an examination of the sonic world of a city as experienced by the body**, by means of a walk along Spencer Street, Melbourne. It revealed the noisy and textural nature of this sonic place: a collage involving sounds which are layered, repetitive and have different rhythms, in a setting of constant movement and change. From my listening, within this chaotic territory the body appears to allow the elements to cohere and to create a more stable perceptual point of view for the listener.

These works offer perspectives of the world from the personal viewpoint of the body of the recordist.

## 4. The Body and Instrumental Performance.

My performance works have involved exploring approaches to improvisation using both body sounds and instrumental sounds. Prior to discovering how to amplify and record body sounds in real-time, I used a MIDI foot-controller to trigger body sound samples, while playing a woodwind instrument (a flute or clarinet).

The next development occurred after working on the stethoscope-microphones (Project Proposal, p. 35). In these works, **I explored the body in the activity of making music.**

### 4.1: Initial Works

**File 13: The Body and Alto Flute (excerpt), 4 October 2013,**

**(00:56:35).**



This recording was made into Logic Pro using two stethoscope-microphones for gut and heart sounds, a Thumper microphone for breath recording and an external instrument microphone.

There was no attempt to improvise with the body sounds; rather, my purpose was to record the body while improvising on the flute in order to hear the body in its natural state. It became apparent that the flute sound was also recorded by the body sound microphones, where it sounded softer, timbrally darker and located in a different and more internal space. But overall, the flute

seemed integrated with the body sounds, perhaps due to its association with breath as the instigator of sound.

**File 14: The Body, Improvisation, and Contra-Alto Clarinet,  
(excerpt), 15 October 2013, (01:29:12).**



In this recording, I improvised with my breath and contra-alto clarinet, while recording my heart, breath and gut sounds. In view of my earlier discovery with the flute recordings that the flute could be heard in the microphones used for recording the body sounds, I decided not to use a separate instrument microphone with the clarinet, but to rely instead on the body microphones for recording its sound. Like the flute, the timbre of the instrument seemed integrated with the body sounds. The fact that there was no external microphone to capture the higher harmonics and reverberation of the clarinet sound within the room, meant that the instrument sounded (to my listening) as if it was located within the internal space of the body.

## **4.2: Woodwind Performance and Duet Works**

**File 15: Bass Flute and Breath Sounds (Belinda Woods), and  
Contra-Alto Clarinet and Breath Sounds (Graeme Croft), 19 March  
2014, (07:18:22).**



I have outlined earlier my performance methodology involving the use of the stethoscope and Thumper microphones, an interface, a computer with performance software which I wrote in Max/MSP, software-based and external EQing of sounds, external compression of heart sounds, a MIDI controller to manage the individual volumes of the sounds used for improvisation, and a six-channel powered speaker system (four powered speakers and two subwoofers) for sound output.

As I have described, I developed three sets of duet works: with myself playing my body sounds and a colleague playing concert or alto flute, a second set, with myself on contra-alto clarinet and amplified breath sounds, and my colleague on bass flute and breath sounds, and a third set, a body sound duet, for a colleague and myself each playing our heart, breath and gut sounds.

Next, I made a set of recordings in a professional recording studio to document these developments. The recording methodology in that setting differed from recording a live performance in that powered speakers were not used: signals were routed directly to the recording desk.

The breath, flute and clarinet set of improvisations explored **the compositional use of timbre** (the bass flute, contra-alto clarinet and breath sounds have timbral similarities), and **performance techniques** (vocalising, the use of the breath and the breath as a voice). They also looked into **ways of creating distinctions between the two bodies**.

A problem which occurs with body sounds is that timbral differences between performers are not easily heard. Distinguishing one body from another relies heavily on panning the sounds into clearly separate locations, exploring minimal timbral differences between sounds, and individual differences between performers in their gestural use of sounds.

The works also involved a particular **representation of the sonic body**: as chaotic, uncontained and primitive.

Several issues became apparent with these recordings. I found that listening was confusing due to the combination of external and internal spaces. For example, the flute appeared to occupy what sounded for the most part, like an external space, and the body sounds, an internal space. This made the two musical voices difficult to integrate.

Secondly, the lower frequencies of the flute sound were recorded by the internal body sound microphones of both performers, as well as by the flute microphone, which meant that there were two timbrally different representations of the flute. The fact that the flute was also (unintentionally)

recorded by the microphones of both performers, meant that the flute was heard in both left and right sound fields, and had conflicting spatial representations.

## **5. Integrating the Body, Performance and the Natural Environment**

My final performance developments involved using my field recordings as additional improvisatory materials, and including the human singing and spoken voice in a new set of works.

I selected six of the previous field recording files which were contrasting and interesting sonically: from the country property at Tolmie, the Cheviot Tunnel, Spencer Street Station, Spencer Street near the Yarra River, the Victoria Market and Sydney Road. I modified each of the performance Max patches by adding a stereo file player, routed the output of the player to my output system via gain sliders, and allocated a knob on the MIDI controller to control the gain sliders so that I could control the output volume of the field recording. The Max patch was set up so that any one of the six field files could be selected, loaded into the file player and used in the improvisation along with the body sounds.

I initially rehearsed with my musician colleagues using all six field recording files and later nominated two of the field recordings for each performer duo in order to provide each duo with contrasting material. For example, the recordings chosen as additional materials for the Body Sound Duet were from the Cheviot Tunnel, near Yea (a rural bush environment) and from Sydney Road, Brunswick (an inner city soundscape).



In performance, the work is created by the mutual contribution of each musician to the improvisation, in which I can additionally select, loop and play a field recording file.

**File 16: Body Sound Duet (Ben Simmons and Graeme Croft)**  
**including material from a field recording at the Cheviot**  
**Tunnel, Yea, Victoria, 31 January 2014. Recorded 9**  
**September, 2014 (07:12:34).**



This recording is from a recording session at a professional studio. As with File 15, the signals were routed directly from my interface to the recording desk.

This work explored **sounding bodies in time and space**. There were disjunctions in time, as represented in the sonic dimension: the original Cheviot Tunnel recording was made in January 2014, and the combined recording session was in September. As a result, the recording features the sounds of three bodies, two from the September session, and one from January. While listeners in a performance environment would realize that the field recording was made earlier at another place and time, they may have difficulty making distinctions between the different bodies involved.

The work also involves disjunctions in space. The separateness of the body spaces of each of the performers was initially established by panning the sounds of the performers right and left; it is difficult to distinguish the bodies only on the basis of the timbre of their sounds, or the gestures which typify each performer.

When the field recording material is heard, these distinctions become less clear. There are still differences between performers based on panning, in that the body in the field recording is panned centrally, in its own space. But the low-pitched heart sounds are difficult to localize despite panning distinctions due to their low pitch, and also make for confusing listening due to interesting phasing effects.

# Curriculum Vitae

## 1. Education

**March 2013--March 2015:** Masters in Fine Arts by Research candidate,  
RMIT University, Melbourne.

**2008--2012:** Bachelor of Music, NMIT, Fairfield.

**1991--1992:** Student, Bachelor of Music Performance (classical double bass),  
Victorian College of the Arts, Melbourne (not completed).

**1986:** Fellowship of the Royal Australian and New Zealand College of  
Psychiatrists.

**1979--1984:** Membership of the Royal Australian and New Zealand College of  
Psychiatrists.

**1970--1976:** Bachelor of Medicine, Bachelor of Surgery, Adelaide University,  
(awarded 1977).

## **2. Relevant Performances**

**October 2014:** Performance with vocalist Sarah Whitteron at the RMIT Fine Arts Practice Research Symposium, on the 23rd October.

**March 2014:** Performance at 'La Mama Musica', La Mama Theatre, Carlton, on March 10, which included two works arising out of this Masters project: for internal body sounds and flutes, and for breath sounds, contra-alto clarinet, and bass flute, with myself and Melbourne flautist, composer and PhD candidate at the Victorian College of the Arts, Belinda Woods.

**October 2013:** Performance with RMIT PhD candidate, Sarah Edwards at the RMIT Fine Arts Practice Research Symposium, on the 24th October, titled: 'Communicating Vessels: the Body as Voice'.

## **Recordings**

Listeners to these works need to be aware of listening issues to do with the low frequency reproduction of the heart sounds (Project Documentation, p. 80).

### **Disc 1: Documentation of Works**

### **Disc 2: A Consideration of Three Perspectives**

The sounds files from each of these discs have been attached to this document for listening as .mp3 files and/or are located separately as .wav files.

## **Appendix**

Notice of Ethics Approval for the project, from the Design and Social Context  
College Human Ethics Advisory Network at RMIT University (CHEAN)  
(next page).

**Notice of Approval**

**Date:** 17 December 2013

**Project number:** CHEAN A 2000890-05/13

**Project title:** The Human Body as an Instrument: An Investigation into its Music

**Risk classification:** Low Risk

**Investigator:** A/Professor Philip Samartzis and Dr Graeme Croft

**Approved:** From: 17 December 2013 To: 31 March 2015

I am pleased to advise that your application has been granted ethics approval by the Design and Social Context College Human Ethics Advisory Network as a sub-committee of the RMIT Human Research Ethics Committee (HREC).

## Terms of approval:

**1. Responsibilities of investigator**

It is the responsibility of the above investigator/s to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by the CHEAN. Approval is only valid whilst the investigator/s holds a position at RMIT University.

**2. Amendments**

Approval must be sought from the CHEAN to amend any aspect of a project including approved documents. To apply for an amendment please use the 'Request for Amendment Form' that is available on the RMIT website. Amendments must not be implemented without first gaining approval from CHEAN.

**3. Adverse events**

You should notify HREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

**4. Participant Information and Consent Form (PICF)**

The PICF and any other material used to recruit and inform participants of the project must include the RMIT university logo. The PICF must contain a complaints clause including the project number.

**5. Annual reports**

Continued approval of this project is dependent on the submission of an annual report. This form can be located online on the human research ethics web page on the RMIT website.

**6. Final report**

A final report must be provided at the conclusion of the project. CHEAN must be notified if the project is discontinued before the expected date of completion.

**7. Monitoring**

Projects may be subject to an audit or any other form of monitoring by HREC at any time.

**8. Retention and storage of data**

The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

In any future correspondence please quote the project number and project title.

On behalf of the DSC College Human Ethics Advisory Network I wish you well in your research.

**Suzana Kovacevic**

**Research and Ethics Officer**

College of Design and Social Context

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